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COVER: **Merry Christmas** from the Army Aviation School. With this greeting comes an important change on our cover. Note that it is now Fort Rucker. This change became effective 28 October 1955, but unfortunately our November issue had already gone to press.

This copy is not for sale. It is intended for more than one reader.
PLEASE READ IT AND PASS IT ALONG

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The printing of this publication has been approved by the Director of the Bureau of the Budget, 13 August 1954.

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Manuscripts, photographs, and other illustrations pertaining to the above subjects of interest to personnel concerned with Army aviation are invited. Direct communication is authorized to: Editor-in-Chief, ARMY AVIATION DIGEST, Army Aviation School, Fort Rucker, Alabama.

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THE COMMANDANT'S COLUMN

Brigadier General Carl I. Hutton, *USA*

The views expressed in this article are the author's and are not necessarily those of the Department of the Army.—The Editor

A Trip Through the Index

This issue completes Volume I of the *Army Aviation Digest.* Following accepted practice, the editorial staff has provided a cumulative index for convenience in binding and for assistance to librarians. Incidentally, the index furnishes some other information, also.

Approximately 90 percent of the material in Volume I was originated, written, or prepared by personnel assigned to Fort Rucker. It is certainly appropriate for the Army Aviation School to take the lead in publishing the *Digest,* but the publication is entitled "Army Aviation Digest" and not "Army Aviation School Digest." The broader title assumes that the *Digest* is an Army-wide publication, in which everyone has an interest. The narrower title of the "School" Digest implies that the material therein is primarily academic in concept and scope. If the broad title is to be retained in good faith, there must be greater participation from personnel who are not associated with Fort Rucker.

Aside from material supplied by the Army Aviation School, the index shows that with a few exceptions—thank you, Colonels Byrne, Downing, Forrest and McMahon, and Lieutenant Colonels Harrison and Shea—articles have been written by junior officers. They are enthusiastic, clever, and ambitious, and their articles are gratefully accepted. But where is the leadership from our senior officers? Some of the unfavorable criticism received has come from those very people, and our only answer must be that it is the type of

magazine which they make. In our view, the ticket which allows criticism is a by-line on material for publication.

What sort of material do we want? In general, the choice can be left to the authors. Write about your ideas, experiences, beliefs, and unbeliefs. You are not limited by a "party line." Many aspects of Army aviation are controversial and both sides should be displayed for examination.

There are several fields in which a great deal of material is needed. Among these are: combat experiences, training programs, specific complaints about the Army Aviation program, descriptions of ideal equipment, solutions for maintenance problems, notes on inspections of air sections, safety programs, flying experiences ("I learned about flying from that" or "Hangar Flying"), and communications problems and solutions.

If our publication is to be a true *Army Aviation Digest*, it is up to everybody in Army Aviation to make it so. Otherwise, it is bound sooner or later to shrink to a mere academic publication, and this does not appear to be what we want.

This is the ninth in a series of columns written by Brigadier General Carl I. Hutton, Commandant of the Army Aviation School, for the ARMY AVIATION DIGEST.—The Editor.

1954 Accidents by Phase of Flight

Out of 352 fixed- and rotary-wing aircraft accidents reported during 1954 to the Army Aviation Safety Board, Army Aviation Center, Fort Rucker, Ala., the following number occurred during the five phases of flight listed:

Landing	137	Hovering flight	41
Autorotations	44	Low-level flight	29
Take-off	43		

HELICOPTER MOUNTAIN OPERATIONS

Captain Ernest C. Smith, *Transportation Corps*

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

Pilots who have flown rotary-wing aircraft in Korea, with the 30th TOPO in Alaska, with air sections at Fort Carson, Colo., and in the Alps of Europe have found that special techniques must be developed in order to cope with the unusual problems of mountain flying.

Recently I completed the Mountain Helicopter Operations Training Course conducted by Okanagan Helicopters, Ltd., in Penticton, British Columbia. Okanagan Helicopters is a commercial organization which has been operating in the Canadian mountains for the past 6 years supporting the building of the Kamano Dam and the Kitamat Road as well as many other projects. This support entailed extensive survey work; transporting survey parties and equipment into rugged Canadian bush country; air-lifting tools, materials, and personnel for the building of camps; and sustaining these camps by resupply. Over the 6-year period, while operating H-13's and H-19's with heavy loads at altitudes from 5,000 feet to 10,000 feet, Okanagan pilots made a comprehensive study and developed techniques which insure safe, continuous, and economic operation in rugged mountainous terrain. In most instances, Okanagan flight techniques closely parallel those developed by Army pilots in Korea, in Alaska, and at Fort Carson.

During the course, loads of 356 pounds were carried to 8,100 feet in H-13 type helicopters. Student pilots flew external loads of lumber, plywood, sand, and fuel (in 5 and 10 gallon containers) and internal loads of personnel and tools. The most critical density

altitude condition worked was 9,600 feet. Each student made approximately 60 landings between the altitudes of 7,000 and 8,000 feet and approximately 90 at 5,000 feet and below. The landings were made to platforms, pinnacles, ridges, saddles, alpine meadows, criques (a steep-walled bowl), creek beds, and slopes.

It is the purpose of this article to highlight techniques observed during my attendance at the Okanagan course and to point out the differences between low altitude and high altitude flying in rotary-wing type aircraft.

Most rotary-wing operations in Army aviation have been conducted at altitudes lower than 3,500 or 4,000 feet. Usually, normal techniques, such as normal and steep approaches, are effective in operations at these lower altitudes. However, aerodynamic efficiency of the helicopter decreases rapidly at high density altitudes (most always found in mountainous terrain), and its performance becomes much more critical under a heavy load condition.

In addition to these aerodynamic problems, there are psychological problems which are encountered by pilots flying over rugged mountain terrain. A smooth running engine will sound rough, and normal vibrations seem to grow in magnitude and frequency. Other factors, including marginal weather and often operating many miles from civilization or any possible human help, contribute to the feeling of apprehension experienced by pilots unfamiliar with mountain flying.

A limitation of present-day helicopters dictates a change of pilot technique in order to fly in mountainous terrain safely. The

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limitation is the decrease in engine horsepower at high altitudes. This decrease results in a loss of main rotor blade efficiency since its pitch must be increased. When the critical pitch angle is exceeded (overpitching), a decrease of rotor rpm and lift is the result.

High-altitude Techniques

This mechanical reduction in aerodynamic efficiency is made more critical by the rapid changes in density altitude that always accompany free-air temperature changes and by the inconsistent wind conditions prevalent in mountainous terrain. Under heavy load conditions and in the critical atmosphere that exists at a high density altitude (5,000 to 7,000 feet), it is not usually possible to hover, take off, climb, deliver an external cargo drop, or land while utilizing normal helicopter flying techniques. However, by employing special high-altitude techniques these maneuvers can be performed. The following procedures, as taught in the Okanagan mountain training course, are the safest.

All take-offs and landings should begin and terminate at the ground. Good hovering technique is essential, but hovering should not serve as the origin or terminus for take-offs and landings. When hovering is necessary, hover as low to the ground as possible and not higher than 1 foot. A low hover requires a minimum amount of power, reducing the possibilities of rpm loss and settling onto the ground; but, in the event of settling, the helicopter will touch down gently from the 1-foot height. Hovering turns should be made to the right because the pitch of the tail rotor blades is reduced, thus requiring less power. Although take-offs from the ground are recommended, *a low hover check should be made before take-off in order to verify c.g. loading and power potential.*

Power-surge

When working at high altitudes, use a "power-surge" for each take-off and during the final stages of the approach. A "power-surge" take-off means that the helicopter becomes airborne while the engine and rotor rpm's are increasing. This method does not mean necessarily an "over-rev," but it will provide for an "over-rev" if required. Translational lift must be gained before too much pitch is applied; otherwise, rpm will decrease, and the helicopter will settle onto the ground. If the terrain falls away from

the point of take-off, the pilot can pick up translational lift by descending. For example, during take-off, when the rpm needle swings past 3,000 to 3,100 (H-13), start applying pitch and moving forward at the same time.

The same type of technique is used when landing. Prior to the time to touchdown or cargo drop (or sling pickup), increase the rpm. A surge of 50 to 100 rpm should be used to cushion the landing or to sustain the helicopter momentarily for sling operations. However, the pilot must be careful to avoid overpitching (pulling too much pitch and losing rpm) when absorbing this additional surge. The operation must be coordinated so that the maneuver is complete before more than the surplus rpm provided by the surge is lost.

Take-off

Take-offs from mountain pinnacles fall into three general classifications.

1. *Power-surge take-off with a nudge-down of collective pitch.* Lift the helicopter from the ground and gain forward speed immediately. Then, reducing collective pitch slightly, drop over the side of the pinnacle to get into translational lift. Reducing the collective pitch slightly decreases the possibility of reaching a critical pitch angle of the main rotor blades, which would result in a loss of rpm.

2. *Low creep-off.* This type of take-off is used when there is a shallow, descending slope instead of an abrupt drop-off of the take-off site. Again, translational lift is the key to dependable flight. It is attained by slowly creeping forward at a very low hover while going down a shallow slope to a steeper drop-off. Altitude is sacrificed to gain airspeed until translational lift, or "fly-away," becomes safe.

3. *Combination of the above.* A combination of the two above methods is used in areas that are too flat for a drop-away and too rough for a running take-off. It is a rarity when mountainous terrain will permit a running take-off or running landing.

Climb

When climbing up to altitude, make full use of *updrafts* and avoid *downdrafts*. In most cases, the updraft is comparatively close to the slope on the upwind side of the mountains; therefore, flight will usually be close to the terrain. This method of climbing is called "contour crawling," which simply means taking full advantage of wind conditions. Even when there is little or no wind, there will always be a gradient passage of air over a ridge. For instance, in latitudes where the sun shines most of the day, the air responds to temperature changes accordingly. In the cool of the morning and evening, the air flow tends to be downhill. Conversely, as the sun heats the terrain, the air flow tends to be uphill. Therefore, during the heat of the day, the best route up to altitude is along the sunny side of a slope, or sunny areas in a valley.

Without taking full advantage of wind conditions through contour crawling, it may be impossible to obtain the altitude desired. Further, learning to utilize all existing updrafts will provide greater safety and make possible the lifting of a heavier payload to higher altitudes.

Vertical drafts should also be carefully considered when flying cross country. When crossing ridges into the wind, fly at a higher altitude, as you will be approaching on the downdraft side. You can cross the ridges at a lower altitude when flying downwind as you will be approaching on the upwind side of the ridge. However, at any time you cross a ridge at a low altitude, approach on an angle so that you will be able to make a quick, easy turn-off from the hillside in the event that a serious downdraft is encountered. When the helicopter is above the peak, a direct course can be safely taken. The cardinal rule to follow is: Never get caught in a downdraft condition unless you can make an immediate turn-away over lower terrain.

Approach

In making a reconnaissance for landing, make at least one dummy-approach, in which a landing or drop is not made, to complete the evaluation (which includes consideration of wind effect, slope, and clearance of obstacles) of the landing site. This, of course, is executed after consulting the *density altitude chart* for an estimate of aircraft performance under the particular atmospheric

conditions. The take-off must also be visualized prior to landing to prevent the possibility of being placed in an unsafe condition because of wind, terrain, or obstacles in the take-off path. The fact that the wind is subject to change before the estimated time of departure must be given careful consideration.

Approaches should be flat (0-5 degrees), terminating in a landing or delivery of a sling load. In some instances, entry may be made from below the horizontal, or landing site. Background of the landing site must also be considered. A high background generally causes a tendency on the part of the pilot to steepen his approach, and a low background causes a tendency to overshoot. The rate of descent, if any, must be slow, and forward speed must be progressively dissipated from entry to termination. At no time during the approach should a flare be used to slow the rate of closure. Recovery from a flare at high density altitude absorbs much of the already-critical power and invariably leads to overpitching, loss of rpm, and settling.

The approach may be made from any direction on the updraft side of the landing spot. Normally the terrain will dictate the route. Full advantage must be taken of exit routes, or, as termed in the Okanagan course, of a "turn-away into a drop-off." In reference to the wind and slope, the approach may vary from crosswind, cross-slope, to downwind, up-slope. The landing may terminate with the wind on the nose or tail or across the fuselage, as velocity and turbulence will permit. Even though a downwind landing is reasonably safe in light winds, the downdraft side of a mountain must be avoided. A landing site should never be selected on the downwind (downdraft) side of a ridge.

Landing

As mentioned above, during landing, a power-surge should be utilized in high density altitude conditions. As the final stage of the approach is reached (80 to 75 feet from touchdown), a surge (rpm increase of 50 to 100 rpm) is applied. The surge of rpm is used to cushion the landing and if possible, is maintained until the weight of the helicopter is firmly on the ground or the sling load has been delivered. The flat approach should again be emphasized. Because of the very low rate of descent in a flat approach, a nominal increase in approach power is all that is required to land safely. A simple rule of thumb can be used to determine power available

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FORT CARSON, COLORADO

Captain Wesley W. Brisben, *Artillery*

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

We at Fort Carson feel that flying conditions in this locale are unique in Army aviation. Although I have been here only 6 months, I speak as a pilot transitioned from a 3,200-foot strip 400 feet above sea level in Germany to a 3,700-foot strip at approximately 6,000 feet above sea level at Carson. Needless to say, flight techniques required in the two situations are considerably different.

Fort Carson is located south of Colorado Springs and about 10 minutes flying time from Pike's Peak. The elevation of Peterson Airport, from which the 8th Infantry Division aviation section operated until recently, is 6,172 feet. Minimum flight altitudes in the Colorado Springs-Denver-Laramie area range from 8,000 to 14,000 feet msl. Many of the mountain peaks to the west, including Pike's Peak, have elevations from 12,000 to 14,000 feet.

The high altitude and other factors of mountain flying, dictate the peculiarities of Fort Carson operations. All of us have at one time or another received ground school training in the hazards of mountain flying; and aircraft handbooks contain operational data applicable to high altitude operation. However, reading about peculiarities of high-altitude flying, or hearing them discussed, cannot effectively impress on either the rotary-wing pilot or the fixed-wing pilot the difference in taking off from a runway 6,000 feet above sea level and taking off from one at, say 1,500 feet above sea level. Neither does it adequately prepare him for the turbulent atmospheric conditions surrounding high mountains. The pilot without previous flying experience under these conditions requires some practice before he flies daily missions with his accustomed confidence.

Four separate aviation sections are presently operating out of Fort Carson and some 24 rotary-wing and fixed-wing pilots are assigned to the post. There are always "new arrivals" in the four sections. Consequently, a standardization program for mountain flying was recently begun at Fort Carson. Designed to increase pilot efficiency under operational conditions peculiar to the area, the program is conducted on an individual basis. Each new pilot is given dual time with more experienced pilots, the amount depending upon his needs and previous experience. In addition, the SOP emphasizes hazards of operation at high altitude and the Koch chart for altitude and temperature effects, taken from the back of the Denver sectional chart, is posted for reference.

Density Altitude

One thing which is impressed upon the newly-arrived pilot, and a factor which even the seasoned mountain flyer must give due respect to with every take-off and let-down, is density altitude. Landing strips in the Fort Carson area have an average elevation of 6,000 feet; and the runway at Camp Hale has an elevation of almost 10,000 feet. Only prepared landing areas are used, even for strip work with battalions, because the density altitude factor is extremely critical. A pilot might get off of a strip quite easily early in the morning, but by noon or early afternoon take-off could be impossible. High altitude plus heat can cause required take-off distance increases as high as 300 percent. For example (see Koch chart), a ground temperature of 86° Fahrenheit, at a 6,000-foot altitude causes a 200 percent increase in normal take-off distance. If the mercury hits 100°, the increase is almost 250 percent. One

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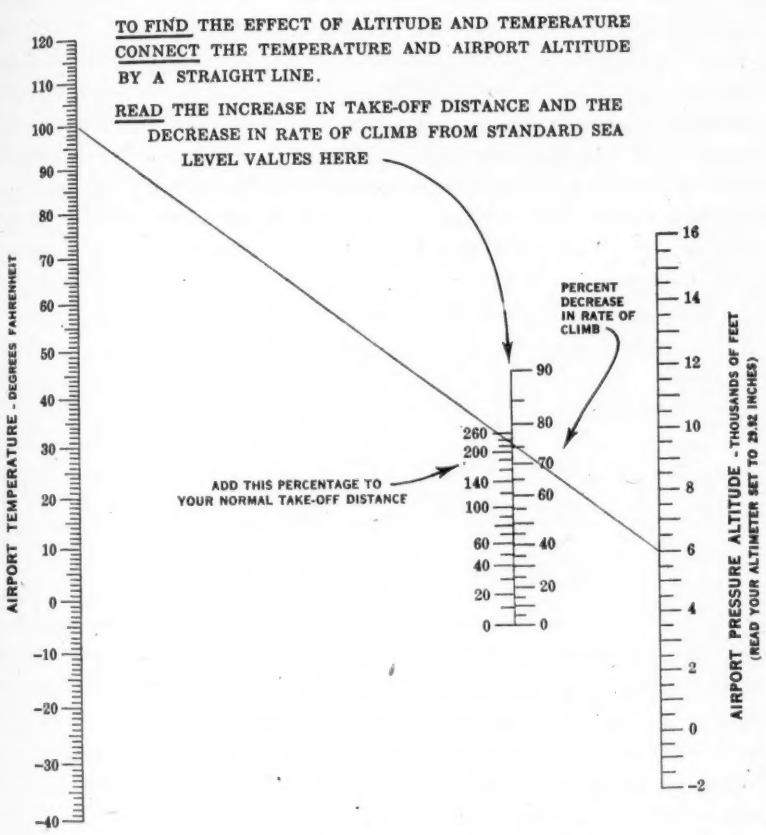
THE KOCH CHART FOR ALTITUDE AND TEMPERATURE EFFECTS


TO FIND THE EFFECT OF ALTITUDE AND TEMPERATURE CONNECT THE TEMPERATURE AND AIRPORT ALTITUDE BY A STRAIGHT LINE.
READ THE INCREASE IN TAKE-OFF DISTANCE AND THE DECREASE IN RATE OF CLIMB FROM STANDARD SEA LEVEL VALUES HERE
AIRPORT TEMPERATURE - DEGREES FAHRENHEIT
120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40
PERCENT DECREASE IN RATE OF CLIMB
90 80 70 60 40 20 0
ADD THIS PERCENTAGE TO YOUR NORMAL TAKE-OFF DISTANCE
260 200 140 100 60 40 20 0
AIRPORT PRESSURE ALTITUDE - THOUSANDS OF FEET (READ YOUR ALTIMETER SET TO 29.92 INCHES)
16 14 12 10 8 6 4 2 0 -2

day last summer, the percentage increase required under existing conditions went completely beyond the Koch chart posted in the air section operations room. During a 7 a.m. demonstration in June, flaps had to be used to get an L-19 over a 30-foot barrier at the end of a 2,000-foot runway. At a 6,000-foot elevation most barrier approaches look like wheel-landing approaches. The strip from which the 8th Infantry Division air section is now operating has an additional peculiarity to be coped with in that it is located on a mesa with 100- to 150-foot drops at both ends. No matter which direction the wind is from, landing into it, the pilot gets a considerable down-

draft from the end of the runway and must make a faster than usual final approach.

Rate of climb, of course, decreases tremendously at altitudes above 6,000 feet because of the loss of the rated horsepower of the aircraft. The main reason for this loss of power is that air entering the carburetor is much less dense than the same amount of air at lower altitudes. With an outside temperature of 50° Fahrenheit, rate of climb at 4,000 feet is decreased 40 percent; at 6,000 feet, 60 percent; and at 10,000 feet, almost 85 percent (see Koch chart). Pilots flying through the mountains surrounding Fort Carson must climb at much higher power settings than those normally required. With the L-19, these increased power settings usually result in excessive engine wear. The high altitude also causes indicated airspeed to be lower than normal. For example, the L-19 cruises at approximately 80 to 85 mph indicated airspeed. Maintaining altitude in the mountains is somewhat like flying with an elephant in the back seat; the nose must be kept up to maintain a constant altimeter reading. As a concession to the load factor, the personnel load of the L-20 has been cut from six to four, including pilot, for mountain flights.

Helicopter Operation Critical

Density altitude, of course, has an even greater adverse effect on helicopter operations at Fort Carson. In fact, it is almost impossible to get them airborne when the mercury rises to 85°, unless there is a 25- to 30-knot wind. Hovering and taxiing are done very close to the ground, and translational lift must be picked up as quickly as possible. Running take-offs with skids clearing the ground about 6 inches are used exclusively. The greater lifting power of the H-25 seems to make it generally more adaptable to high altitude operations than the lighter, observation-type helicopters. H-25 helicopters have been used at Fort Carson under many marginal conditions in which the observation-type helicopter was not flyable. This was done by stripping the helicopters of lining, hoist, slings, cushions, and all excess baggage (resulting in a payload gain of about 140 pounds) and reducing the gas load to about 500 pounds. The loss of rated horsepower at high altitudes causes the load factor to become extremely critical in all helicopters. For example, with the approved load, the H-13 requires almost ideal weather conditions. The "stripped down" H-25's, however, will

operate successfully under many marginal conditions. At 5,000 to 6,500 feet above sea level, the most efficient indicated airspeed of the H-25 is about 55 knots. Retreating blade stall develops at the normal 70-knot cruise speed.

In the summer, another peculiarity of flying in the shadow of Pike's Peak is coupled with the density altitude factor (always more critical in hot weather) to make operation extremely critical. This is the turbulence ever present in mountainous terrain and increased during the summer season by almost daily thunderstorms. Updrafts and downdrafts along the contours of the mountains are so severe that a plane can be caught in one and carried 1,000 feet before the pilot can regain control.

Study Mountains

Pilots at Fort Carson study the mountains and learn to know them. Every crossing presents a different problem. One axiom of mountain flying is always to ride the windward side of a ridge. Wind can be compared to water as it flows up, over, and down the mountain ranges. On the windward side are the updrafts; on the leeward side, the downdrafts. Abrupt change of wind direction and velocity is, therefore, more critical in mountain areas. Very dangerous turbulence can be expected close to abrupt changes of terrain. Cliffs or other rugged areas are avoided.

When flying in mountainous terrain, a pilot should fly along the ridges whenever possible. In this case, following along the top one-third of the ridge on the windward side is generally accepted as the best track. Over mountain passes, winds have a much greater velocity than reported a few miles away. These passes should, therefore, be crossed with as much altitude as possible. Crossing passes, or ridges, at a 45-degree angle, rather than head-on at a 90-degree angle, is always advisable because the smaller angle permits a 90-degree turn-off into lower country in the event severe downdrafts are encountered or engine malfunction occurs. (See "Helicopter Mountain Operations" in this issue—Ed.) Operations on the leeward side of a mountain should be avoided. On the windward side, the pilot should employ the soaring technique to climb up a mountain slope. By staying reasonably close to the mountain side, he gets full advantage of the updrafts in attaining desired altitude. However, a pilot should not ride up a slope with clouds on the opposite side expecting to fly under them because clouds build up close to

the mountain very rapidly. Even with pilots employing these techniques of mountain flying, it is not unusual for turbulence to pop out the overhead windows of L-20's or buckle the wing panels of L-19's.

Weathermen at Fort Carson are out on the proverbial limb with every forecast. The brief, strong local thunderstorm characteristic of the area during the summer months comes up without a moment's notice. Therefore, pilots are constantly checking weather conditions at points along their routes and at points of proposed landings. Rainstorms are very heavy, but usually only 15 to 30 minutes duration over any one area. Therefore, pilots "wait it out" in preference to landing during one.

While Fort Carson has more than an average share of disadvantageous altitude and weather factors, one advantage of the locale is probably not surpassed anywhere in the continental United States. This advantage is almost unlimited visibility. On a clear day, pilots can see for a distance of 100 miles or better. The rarefied air at that altitude also increases night visibility tremendously. Over the Fort Carson strip at an altitude high enough to clear intervening peaks, one can see Denver, approximately 70 air miles away.

Summary

In summary, the basic "do's" and "don'ts" for mountain flying, whether it be over the Rockies, the Smokies, or the Alps:

1. Don't forget to check your weather.
2. Don't fly in doubtful or bad weather.
3. Don't fly when winds aloft at your proposed altitude are above 30 knots. Expect winds to be of much greater velocity over mountain passes than reported a few miles away.
4. Plan your route along populated areas and well-known mountain passes, as a precaution in case of forced landing and as an aid to pilotage.
5. Be sure that you have a sectional aeronautical chart (or the equivalent) of the area. Read the reverse side of the chart for pertinent data on flight conditions characteristic of the area. Study the chart for the best method of crossing difficult areas.
6. Use your radio often in obtaining weather information along the route and at destination because frequent weather changes can be expected over mountainous terrain.

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COMMAND AVIATION

Captain James F. Thompson, *Artillery*

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

Throughout the history of military organizations, communication with parallel and subordinate units has been a major problem. In the past few years, this problem has been greatly alleviated in higher support commands, such as a communications zone command, by the addition of organic Army aviation. No T/O&E provisions exist at present for organic Army aviation in a communications zone headquarters organization or in logistical commands. However, since WWII several such aviation sections, including the Korean Communications Zone section, have been organized on a TD/TA basis.

Organic aviation at this level is new to many commanders and staff officers, and it presents possibilities heretofore unexplored. Proper utilization of this tool is often the subject of discussion among officers well acquainted with the capabilities and limitations of Army aircraft and of much speculation by those whose training and experience did not include this subject.

Basically, Army aviation in support of a communications zone or a logistical command is expected to provide general liaison for the headquarters and to provide limited aerial transport, emergency evacuation, and courier service for the headquarters and associated units in the command.

A command aircraft is provided for the use of the commanding general and his staff in making necessary inspections and liaison visits. A number of additional multipassenger aircraft augment the command aircraft and transport staff officers on official business between the headquarters and subordinate commands, and also transport visiting VIP's.

Several two-place aircraft are provided to further augment the multipassenger aircraft and transport other authorized passengers

and mail within the area served by the headquarters. Finally, helicopters provide flexibility of operation, as suitable landing fields for this type of aircraft are easier to find.

Authorized strength for the Aviation Section, Korean Communications Zone, operated by a logistical command and serving units in an area of about 300,000 square miles during the Korean Conflict, consisted of one L-23, six L-20's, two L-19's, and two H-13 type aircraft. Because of a shortage of L-20 type aircraft in the Zone, the actual strength was one L-23, four L-20's, six L-19's, and two H-13 type aircraft.

With this equipment, Army aviation places at the disposal of the commander a means of fast personal transportation and provides a means of performing numerous other missions which contribute to the accomplishment of the overall mission, such as medical evacuation and transportation of supplies. Justification for this support is the mobility and time-saving advantages afforded by air travel, and in a mountainous country where rail and vehicular-type transport is very slow, such support is a necessity.

Organization

The usual arrangement is to organize the unit on a T/D and T/A basis. Assuming that 12 aircraft are required to fulfill the mission, at least 12 pilots are needed to keep the aircraft flying; other duties that must be assumed in order to operate the unit require a small additional number of officers. In the organization of the T/D for the aviation section of the Korean Communications Zone, it was found that a total of 15 pilots allowed the key jobs to be filled,

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such as the aviation officer, operations officer, maintenance officer, and supply officer, and supplied sufficient pilots to keep 12 aircraft flying. Each aircraft requires at least one mechanic, and provisions must be made for the numerous other jobs attendant to operating an air section. A T/D allotment of 22 enlisted men was found to be insufficient for a section of this size; therefore, it is felt that a minimum of 30 enlisted men is desirable. In determining personnel requirements for a unit of this type, one should take into consideration weekly training requirements, rotations, leaves and passes, and time off for special details, which often leave actual duty strength very small.

In addition to maintaining and flying the aircraft, section personnel must keep records, maintain a POL dump, take care of other section supplies, repair radios, control aircraft traffic, perform the usual housekeeping duties, and staff an operations office 24 hours a day.

Operational Procedure

Ordinarily, the aviation officer is a member of the general staff and forms part of the G3 section. In this role he serves as an advisor to the commander on matters pertaining to Army aviation. He is also chief of the aviation section. The other key officers within the aviation section are the executive officer, who acts in the absence of the aviation officer; the operations officer, who schedules flights, maintains records, and is responsible for flight planning and briefing of pilots and passengers; and an aircraft maintenance officer, who is responsible for all maintenance of aircraft. Other officers are utilized as supply officer, communications officer, motor officer, and assistants to the key officers.

The operations officer has the biggest job in the section inasmuch as the job of training, scheduling, and briefing of pilots is alone a highly responsible one. The operations officer must be an experienced pilot familiar with all operational problems which the pilots are likely to encounter. He must possess a comprehensive knowledge of weather and be able to make decisions that affect persons' lives. He must also be tactful and conscientious since he often deals with high ranking officers and visiting dignitaries. The itineraries of VIP's frequently hinge on his evaluation of the situation. He must insure a high rate of utilization of section aircraft. He must make certain that all safety rules and regulations are strictly adhered to.

Upon determination by a commander that a flight is required, a request should be made to the aviation section as far in advance as possible. The operations officer records the request, notes the number of passengers by name and rank, the weight of their baggage, and chooses the airfield nearest the final destination. The day before the desired flight, a schedule is made up, and available aircraft and pilots are assigned missions. The maintenance section arranges its maintenance schedules so that a certain number of aircraft are provided each day for operations. The operations officer consolidates all requests, planning routes and loads to get the maximum number of people to their desired destinations in the least possible number of aircraft. Close coordination between operations and the passengers is necessary in order to fully utilize all available passenger space. In the case of a high priority mission, a pilot may often find himself sitting on the ground waiting for several hours in order to be available when the passenger is ready to return. Commanders should be cognizant of this situation and, if at all possible, avoid it.

Maintenance

The maintenance portion of the section is a unit in itself. The maintenance officer and his assistant are usually very busy supervising repair work, making test flights, and coordinating with the supply section for parts. As the field maintenance facility may be hundreds of miles from the organization, the procurement of parts and making aircraft accessible for field maintenance frequently become complicated problems. Organizational maintenance is continuous, and as much as possible is performed in periods during which the aircraft are not scheduled for flights. The senior enlisted man in the maintenance unit is the line chief, with another noncommissioned officer, who is usually a technical inspector, as assistant. A records clerk and the mechanics complete the unit.

Provisions must also be made for fueling of aircraft and for the handling of transient aircraft. Traffic must be controlled by trained control tower operators. All these functions require manpower which may be overlooked when a T/D is established.

Flight Planning

It is interesting to note that, as a famous poet once said, "The best laid schemes of mice and men gang aft agley." This statement

was never more true than when considered in the light of operating an air section in support of a communications zone because of the comparatively long distances involved. Undoubtedly the biggest plan wrecker of all is the weather. In a mountainous country like Korea, weather reporting and forecasting are extremely complicated. It is almost impossible to predict the weather with sufficient accuracy to make firm advance plans involving the use of light aircraft. The second most disrupting force, and one which can readily be avoided to a large degree, is the problem of last-minute missions. Normally, at least 24 hours notice is required to schedule, arrange, and plan a mission.

Operations and the pilots must have time to prepare for each mission. The pilot must thoroughly understand the route to be followed and the facilities available to him in case of trouble. He must have knowledge of the weather situation and be able to make plans accordingly. He must have time to prepare his maps and charts. Occasionally, a mission that cannot be foreseen, such as an emergency medical evacuation, will come up. But even under the most favorable circumstances, with a pilot ready and a fully fueled aircraft available, it usually requires a minimum of 45 minutes to get an aircraft off the ground. Operating between Air Force bases means that flight plans must be filed. If litters are to be used, the seats in some aircraft must be removed or rearranged.

Flights on Short Notice

Often, a last-minute mission for a fairly routine flight may come up; and, unless aircraft and pilots are kept on a standby basis, scheduled flights must be rearranged to work in the new mission. If the aircraft have already departed on the day's missions, it may be hours before an aircraft can be made available for the new mission. Prior planning on the part of using organizations will eliminate the majority of last-minute, poorly planned missions and will obviate the attendant confusion and frustration for all concerned. As a compromise between standby planes and full utilization of aircraft, the KCOMZ section provides for emergency flights by having at least one aircraft within 1 hour's range of the base at all times.

Another problem that comes up is the attempt to overload an aircraft. Overloading an aircraft is very dangerous. Aircraft loading restrictions must be strictly adhered to, and an understanding

by commanders of the capabilities of each type of aircraft is necessary. The aviation officer should act as advisor on this subject. In the interest of safety to the occupants, single-engine aircraft are not used at night, on instruments, or over water except in case of emergency. If the urgency of the mission outweighs the chance of swimming back or bailing out in case of power failure, single-engine aircraft can be used. As part of their training, Army pilots are required to remain proficient in night and instrument flying.

To avoid crippling the section's operation, aircrews should be exempted from additional duties outside the air section. It is obvious that, if pilots or mechanics are detailed to inventory a post exchange, they cannot operate an aircraft at the same time. Most headquarters personnel realize this essential fact; and, consequently, air section personnel are not called on for administrative details. Details within the section are scheduled so pilots are always available for flying.

Utilization

Army regulations specify that certain utilization factors must be adhered to in order to justify the assignment of each aircraft, depending on its type and complexity. Thirty-five to sixty hours per month should be flown by each aircraft to justify its assignment to the section. If the experience over a 3-month period shows low aircraft utilization, either the requirements do not justify retention, maintenance support is lacking, or pilot training requirements are not being met. On the other hand, if experience shows abnormally high utilization, additional aircraft are needed.

Communications

Communications is an important item in the makeup of an aviation section. Several telephone lines must be available to aviation section offices. Flight scheduling is done almost entirely by telephone, and subsequent cancellations, confirmations, and necessary changes often require a great deal of telephone conversation. The nerve center of the section, operations, must be able to readily contact concurrently the maintenance section, supply, control tower, and adjacent fields, as well as higher and lower commands. A weather teletype is highly desirable for reception of hourly weather reports. A public address system is needed with which to notify

alert crews of incoming flights. Each aircraft must be radio-equipped and able to contact control towers, other aircraft, and ground stations. A separate frequency on which pilots may communicate directly with operations allows the pilot to alert surface transportation for passengers 10 to 30 minutes prior to his actual arrival at an airfield.

Pilot Requirements

Commanders should be aware of the annual training requirements for pilots. All pilots are required by regulations to fly a certain number of hours each year, and for some, flying is their primary duty. The maintenance of high pilot proficiency is very important to commanders from a safety standpoint. Pilots must log at least 80 hours each year, including practice of elementary flight maneuvers and night proficiency, cross-country, and instrument flying. Practice is a must. Additionally, pilots must pass a written examination covering their training each year. It is to the advantage of the service, and particularly to the advantage of the commander of the unit concerned, that he ascertain that pilots of his command consistently meet these requirements.

Summary

In summary, we say to commanders, utilize the tool of Army aviation; it will help to maintain liaison and increase overall efficiency of the command. But in utilizing it, remember the old adage: "Flying is not in itself inherently dangerous but it is unforgiving of carelessness." Help the Army maintain its enviable flying safety record by allowing experts to work out air transportation problems. The aviation officer and his assistants are making a career of aviation, and they have had extensive aviation training and experience. Use their experience. The aviation officer is available for advice on all matters pertaining to Army aviation and is willing and eager to serve. He is responsible for the operation of aircraft assigned to the unit and will most willingly assist in working out solutions to all problems involving Army air transportation.

BOOKS

For the Army Aviator

SEIZURE OF THE GILBERTS AND MARSHALLS—*Crowl, Philip A., and Love, Edmund G. (Government Printing Office, Washington 25, D. C., 1955. $5.75)*

This is the sixth volume of official histories composing "The War in the Pacific" series of *The United States Army in World War II*. The standard set by the Office of the Chief of Military History in the previous volumes has been high, and *the Gilberts and Marshalls* does not let this standard fall. The Army can well be proud of the presentation of its achievements.

Aviators will notice that there is not a mention of Army aviation in *the Gilberts and Marshalls*. Since these actions occurred in early 1944, long after Army aircraft had proved their worth in Africa, Sicily, and Italy, it can only be assumed that the Central Pacific military commands overlooked a valuable tool. This is most obviously true of Tarawa, where the Marines suffered such heavy losses, and Kwajalein, where the 7th Division artillery occupied an adjacent island to support the attack. It should be remembered, however, that the assaulting divisions on the Normandy beachhead likewise made no use of Army aircraft. Major General Clift Andrus, then Commanding General, 1st Division artillery, once told your reviewer that the absence of Army aircraft during the assault was the major mistake at Normandy.

The Gilberts and Marshalls describes many tactical situations in which helicopters could have added speed and flexibility to the operations. Of course, helicopters to do this did not exist then, but, *and this is important*, those weapons which would be used against assault helicopters did exist. Therefore, it is legitimate to use these situations to develop basic helicopter assault doctrine. For this reason, *the Gilberts and Marshalls* is recommended reading for all Army aviators, and especially for those concerned with the formulation of Army aviation doctrine.

SOUND BARRIER—*Duke, Neville, and Lanchbery, Edward. (Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y., 1955. $4.75)*

Already the "sound barrier" has ceased to be a problem of flight, and supersonic aircraft have become the production order of the day. Here is a book which tells both the historical and technical stories of the conquering of this barrier. It gives the reader an understanding of the obstacles already faced and overcome and of the problems ahead. It also provides an insight into the manner in which the team of designer, aerodynamicist, engineer, physicist, and pilot plan the campaign for future conquests of the skies. Particularly interesting is the analysis of the problems which beset the pilot when he pits himself against mysterious natural forces that might bring quick disaster.

"*Sound Barrier*" offers a wealth of knowledge for the aviator interested in the "why's" and "wherefore's" of the strange aircraft designs coming off of today's assembly lines and drawing boards. The book also acquaints him with a new language which as yet belongs to the scientist and the technician but will tomorrow be as much a part of everyday speech as "airplane" and "parachute" are today.

SCIENCE SINCE 1500—*Pledge, H. T. (Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y., 1947. $5.00)*

Going back, via this book, to the days and places of the birth of the cardinal ideas which have shaped our scientific life is an interesting and enlightening journey from which the reader gains considerable insight into the facts of our time and the riddles of tomorrow.

Science Since 1500 not only presents the theories and discoveries but also brings into play the men themselves, showing their puzzlement, their search, and their final triumph. In his account of the panorama of the growth of modern science, the author presents the great inventions, discoveries, and theories of the last four centuries, bringing his survey to a close with major developments during the 1940's.

This department is prepared by the ARMY AVIATION DIGEST staff. Views expressed are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

THE MICROPHYSICAL WORLD—*Wilson, William (Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y., 1954. $3.75)*

As its title indicates, this book deals with the very small things in the physical world.

The author starts with the time when atoms and molecules were no more than hypothetical suggestions to account for prominent features of known chemical and physical phenomena and from there indicates how, with the growing knowledge of such phenomena, these components were found to be not only definite and probable but indeed real. The major portion of the book is devoted to the phenomena of heat, light, electro-magnetism, and radioactivity, which can be traced back to molecules, atoms, and still smaller components, such as protons, neutrons, electrons, and positrons. In covering these phenomena, the author discusses a variety of subjects, including spectra and spectroscopy, x-rays, black body radiation, the cloud chamber, radioactivity, cosmic radiation, the Geiger counter, and the cyclotron.

The Microphysical World is presented in simple language which the layman will read without difficulty and serves as a basis for more advanced study of physical science.

MAGNETIC MATERIALS IN THE ELECTRICAL INDUSTRY—*Bardell, P. R. (Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y., 1955. $10.00)*

Here is a comprehensive reference book for those interested in research and manufacturing developments in the many modern industries concerned with magnetism and magnetic materials.

The author outlines the present position of the theory of ferromagnetism. He then deals with the constitution and characteristics of the "hard" and "soft" magnetic materials which have so far reached the stage of industrial application, making a systematic classification of the materials and their properties. Through his knowledge of the production, measurement, and application of the various classes of magnetic materials, Bardell makes clear the close interrelation of full realization of the high magnetic qualities of modern materials with the design of the systems in which they are to be utilized.

UR HIGHLIGHTS

Major Fred R. Reed, *Transportation Corps*

The views expressed in this article are the author's and are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

The November column contained several suggestions for preventing foreign matter from entering fuel systems. One of the suggestions was to check fuel servicing equipment periodically. In September, TSMC, St. Louis, Mo., advised all major commands of the availability of the aviation gas segregator kit, Ordnance stock number G749-5702046. This kit is for installation on M-49 and M-217 fuel servicing trucks. If you haven't done so, submit your requisition to Ordnance. Instructions covering the installation of the kit are contained in MWO G1-W59, dated 7 February 1955.

The following UR's have been selected for "highlighting" this month:

Fixed Wing

PROBLEM: Instrument Panel Shorting Out Electrical Buss Bar, L-20. 2 Unsatisfactory Reports received.

Both Unsatisfactory Reports described a direct short of the buss bar due to its contact with the instrument panel mounting support channel. Fire resulted. The cause cited in the UR's indicated that the instrument panel was too frail to house panel assembly P/N C2N-2065 and the channel was being bent by pilots' knees. The unsatisfactory condition was investigated by DeHavilland, and Service Bulletin Nr. 61, which outlines a minor modification that will correct the condition, was issued. In addition, TSMC outlined the modification in TO 1L-20-517, which should be in the field by the time this column is published.

This problem was selected for highlighting to show how only one or two UR's receive the same attention as 50 or more. L-20

pilots can thank personnel at Fort Eustis, Va., for reporting this unsatisfactory condition, easily corrected, that could have caused dangerous fires in flight.

PROBLEM: Brake Master Cylinder Leaking, L-23. 12 Unsatisfactory Reports received.

Unsatisfactory reports indicated that cylinders were leaking around the piston. This condition is being investigated by Ogden Air Materiel Area. The findings are not conclusive as yet, but there are some indications that are worth discussing:

1. The principal difficulties of hydraulic systems are caused by seal failure. The service life of a seal depends upon many factors, such as extreme temperatures and operating conditions. Seals, to do the job for which they are designed, must remain pliable. If an aircraft is not being flown daily, the hydraulic unit should be operated at least once daily to insure that seals remain pliable.

2. There is a strong indication that leaks are being caused by foreign matter in the hydraulic system. This *foreign matter* keeps cropping up, if not in fuel systems, in hydraulic systems. Let us drop the *foreign matter* and call it *dirt*! Trouble-free operation of hydraulic systems depends entirely on the effort expended to insure the use of pure fluid in a clean system. It is that simple. Take every precaution during servicing and maintenance operations to prevent *dirt* from entering the system or the fluid. The fluid is packaged in hermetically sealed cans; dirt which gets into it has to get there after the cans are opened. We want more UR's on these brake cylinders. If you find "leakers," report them.

Rotary Wing

PROBLEM: Tail Rotor—Metal Blade Bonding Failure, H-13. 27 Unsatisfactory Reports received.

The UR Highlights Department, prepared by Major Fred R. Reed, is compiled from information contained in Unsatisfactory Reports received by the Transportation Corps Supply and Maintenance Command, 901 Washington Avenue, St. Louis 1, Mo Major Reed is Chief of TSMC's Publication Division.—The Editor

This problem has been extensively investigated by the contractor. Quality control tests have been established to assure improvement of rotor blades. In addition, a redesign of the trailing edge, utilizing a larger lip to provide more bond area and a reduction in rivet stress, has been incorporated in current metal tail rotor blades. The action by the contractor should cure this one but watch it closely, and report any failures.

PROBLEM: Tail Rotor Gear Box Input Shaft Worn, H-13. 9 Unsatisfactory Reports received.

Investigation attributes the condition to insufficient lubrication. Lubrication requirements are being revised to require hand packing instead of the present brush method. Do not wait for the revision; hand pack now.

PROBLEM: Heat Ducting Striking Shafting, H-21. 5 Unsatisfactory Reports received.

Unsatisfactory Reports disclosed fibre glass heating ducts ballooning due to excess heat and pressure, and causing scoring of the rotor-drive shafting. A TO will be published requiring the installation of stiffeners for the full length of the duct in conjunction with vertical tubular spacers to reduce the possibility of the duct contacting the drive shafting.

In the interim, the following procedures should be adhered to during and after operating the heating system:

1. All anemostats and iris valves must be in the fully-open position to preclude the possibility of ballooning.
2. A post flight inspection should be made of the shafts for score marks and of the ducts for ballooning.

In the event any scoring of shafts or ballooning of ducts exists, the following instructions apply:

1. Negligible damage to drive shaft assemblies must be held to limits found in Figure 2-11, page 35, of TO 1H-21(Y)-3, dated 23 August 1954. Inspect and comply with the instructions contained therein.
2. Extensive damage, such as the loss of a major portion of a duct, blanket assemblies, or a support, requires replacement of the damaged part. Any number of repairs by patching or insertion are permitted on the ducts, blankets, or

supports, providing the original strength and alignment are maintained.

The UR submittal rate is increasing, and we like it! But we are greedy and want more. We can help the man in the field, if he will take that first step to help himself by submitting Unsatisfactory Reports.

It is that time of the year, so on behalf of the entire staff of the Transportation Supply and Maintenance Command, a *very merry Christmas to all.* If you want to wish us a merry Christmas, don't send Christmas cards—send UR's!

Don't live, or perhaps die, with an unsatisfactory condition. REPORT IT!

(FORT CARSON, COLORADO continued from page 16)

7. Expect your plane to take a much longer time to take off from an airstrip at high altitude (particularly in hot weather) and to climb at a lower rate. The aircraft has less lift and the engine has less horsepower.

8. Know your wind direction at all times and remember that updrafts will be on the windward side of a mountain and downdrafts, on the leeward side. Watch for abrupt changes of wind directions and velocity in mountain areas.

9. Don't fly closer than necessary to abrupt changes of terrain such as cliffs or rugged areas because of the increased turbulence there.

10. Flying down one side of a canyon is safer than flying down the middle because you are thus able to make a 180-degree turn if necessary.

11. If you encounter a downdraft, do not be alarmed. Keep the nose of the plane down and maintain a normal airspeed. Each downdraft is normally followed by a compensating updraft.

12. Approach mountain passes with all the excess altitude possible; 1,500 to 2,000 feet clearance is preferred on windy days.

13. Fly toward passes and ridges at a 45-degree angle so that you will be able to turn 90 degrees to the low country.

14. Remember that the actual horizon is near the base of the mountain. If you use the summit of the peaks as the horizon, the aircraft will assume an attitude of constant climb.

The Gray Hair Department

The following accident is discussed to bring out two points: first, the incompleteness of the average accident report, and second

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Lieutenant Colonel David G. Cogswell, *above, is the Director, Dept. of Combat Developments, Army Aviation School. A very senior Army aviator, his Army flying career dates back to the birth of Army aviation, when he was one of the "Grasshopper" pilots who demonstrated observation-type aircraft to the Army during the 1941 Louisiana maneuvers. Other "firsts" in his flying career are: the first pilot to use the Brodi device in taking off from an LST during the initial occupation of Japan and, in 1948, the first military pilot to fly a ram-jet helicopter. Colonel Cogswell is a graduate of Harvard University and has completed all Artillery officer and Army pilot courses. He is also a graduate of the Air Command and Staff College. His WWII command and staff positions included assignments as artillery air officer with the 38th Inf. Div. in Hawaii and New Guinea and with the 6th Army in Luzon. In 1947-50, he served with the Research and Development Section, OCAFF. Just prior to his present assignment, he completed a 4-year tour in Europe, where for 2 years he commanded a field artillery battalion in Germany.* —The Editor

and most important, the absolute necessity for thorough preflight checks.

A pilot taxied his L-19 to the run-up position and at this point, let us read the pilot's statement: " . . . after a normal run-up and take-off to the north, I noticed the aircraft handled peculiarly and I found the landing gear vibrating excessively. I climbed out to the east with the intention of remaining in traffic and returning to the field. While at 200 or 250 feet, still in the turn, the engine made a queer noise and cut out almost immediately. It sounded as though the engine was falling to pieces. I went through the forced landing check and set up a normal glide with the intention of landing in the river bed to the southeast. There were a number of military personnel washing their vehicles in the river bed, so I then decided to make a 180-degree turn to the right and land on the relatively clear river bed to the northwest. In the process of this turn to the right, I pulled 30-degree flaps, turned the gas lever to the off position and cut all the switches. The turn was found to be dangerously steep; so I elected to land in the adjacent rice paddies. The airspeed was approximately 70 mph upon touch-down."

The aircraft touched down and skimmed through the rice paddie for approximately 200 feet then nosed over onto its back. Pilot and passenger escaped injury.

The accident report listed the primary unsafe act as: "Pilot failed to attempt a restart of the engine, failed to switch gas tanks, and failed to use the auxiliary fuel pump." In addition, the accident investigation board's "Report of Proceedings" stated, " . . . It is the opinion of the board that the pilot did not use proper forced landing procedure and that he could have landed on an adjacent runway when a vibration was first noticed. It is possible that the fuel was defective as several barrels marked 80 octane have been discovered to contain alcohol."

The description of the accident as stated on DA Form 285 paralleled the pilot's description closely, with the following additions. The report stated "At no time during the pre-takeoff check did the pilot switch gas tanks. . . . Upon experiencing loss of power, the pilot checked to ascertain that the gas selector valve was turned

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The Gray Hair Department is prepared by the ARMY AVIATION DIGEST staff with information obtained from the files of the Army Aviation Safety Board. The views expressed in ths department are not necessarily those of the Department of the Army or of The Army Aviation School.—The Editor

on, but failed to switch tanks. The auxiliary fuel pump was not turned on and a restart of the engine was not attempted." The report pointed out that the pilot began his first turn at 100 feet, intending to stay in traffic and land in order to check the unusual vibrations of the landing gear. Also, it stated that he had completed a turn of approximately 300 degrees, from direction of take-off, at the time he struck the ground.

Investigation by a maintenance team at the scene of the accident revealed that the fuel lines, gascolator, and carburetor were dry and that the mixture control was halfway to the "idle cut-off" position. The team found no evidence of material failure or other reasons for mechanical failure. The engine and accessories were removed for further investigation and tests.

Tests run on the magnetos, carburetor, and fuel pumps revealed no malfunction whatsoever; also, the fuel lines were free of obstruction or clogging. The accessories were reinstalled on the engine and further stand tests made; the engine and accessories functioned very satisfactorily.

The report submitted by the Transportation Corps maintenance company stated, " . . . Since no indication of material failure is evident, no plausible reason can be given by this unit for the loss of power on take-off. Since both carburetor and gascolator were dry and the fuel valve was in the "off" position, it is possible that improper cockpit preflight checks could have resulted in fuel starvation immediately after take-off. The high-pitched whining noise described by the pilot could have been the engine driven fuel pump running dry without a load."

A post-accident medical examination revealed the pilot was physically fit for flying.

Weather conditions at the time of the accident were clear, 6-mile visibility with smoke, 75° temperature, and surface winds east southeast at 5 knots.

Neither the accident report nor the supporting documents revealed what preflight check the pilot made; nor did the report state if the pilot took off with fuel pump on or off; and no further mention concerning the landing gear vibrations was given in any of the accident report documents. Also, no reference was made concerning fuel contamination except the suggested possibility as presented in the board's report of proceedings.

The *primary* cause of this accident as stated in the report was improper forced-landing procedure. But *was* this the *primary* cause?

The accident report intimated that the pilot did not go through the proper preflight procedure but does not state what preflight procedure the pilot did accomplish. There was no mention of the fuel on board; therefore, it is assumed that the tanks were full. The report on technical investigation of the mechanical parts attributed the engine stoppage to fuel starvation. *In view of the facts available, the logical conclusion is that the pilot failed to perform a normal preflight check and took off with the fuel-selector valve improperly set, or with the mixture too lean.*

If the fuel tank selector valve is not seated but is in a between-tanks position, it is possible for enough gas to leak around the valve to permit taxiing and run-up. It is also possible to take off with the selector valve thus improperly positioned if the auxiliary fuel pump is on. The auxiliary pump provides enough vacuum to force the fuel around the incorrectly position fuel-selector valve; however, once the auxiliary fuel pump is turned off, the leakage around the valve will not be adequate to sustain flight. Then, when the fuel lines from the gas tank selector valve, gascolator, and carburetor are drained, the engine stops.

Apparently the pilot did not use proper procedures either in his preflight or forced landing. In the preflight of the L-19, taxiing to run-up position should be done on the auxiliary fuel tank, with a switch to the main tank for run-up and take-off. Thus the engine will run long enough on both tank selector valve settings to insure proper operation of the fuel system. Although it is not a part of the standard preflight procedure as stated in the Flight Operation Handbook, an additional check of auxiliary fuel pump operation can be made to see if the use of the pump will flood the engine. While the engine is idling, approximately 1,000 rpm, switch the auxiliary fuel pump on and note the pressure gauge; if the gauge indicates a fluctuation above normal (approximately 15 pounds) then drops back, holding a reading slightly less than normal (between 10 and 12 pounds), it is functioning properly. If the pump sustains the pressure above normal (14 pounds or more), it is an indication that the fuel pump safety relief valve is out of adjustment; and there is a possibility of flooding the engine when the pump is turned on prior to landing.

Further, had the pilot followed the established emergency procedure, it is highly possible the accident would not have happened. When the engine quit, the pilot was 200 to 250 feet above the ground and he could probably have run through the proper forced-

landing procedure which is: turn the auxiliary fuel pump on; pick a forced-landing area; switch gas tanks; check mixture full rich; and put carburetor heat on. If this procedure fails, and altitude permits, a restart should be attempted by use of the starter. From approximately 200 feet, however, it is doubtful that the pilot would have had time to attempt a restart had the proper emergency procedure failed.

Many pilots are prone to slight details of routine procedures, especially when flying the same aircraft all day. This neglect, however, contributes to approximately 10 percent of all Army aviation accidents. Preflight and cockpit procedures are for the specific purpose of finding discrepancies, preventing malfunction, and, in the end, preventing accidents.

The exact cause of this accident could not be determined from the accident report for one of two reasons. Either a *complete accident investigation* was not made or a *complete report* of the investigation was not written. In either case we have a missing link in our chain of aircraft accident prevention. This report is typical of a large percentage of those received by the Army Aviation Safety Board at Fort Rucker. In order to maintain an excellent aircraft safety record, unit commanders must ascertain that complete investigations of accidents are made and that complete reports are submitted so that the information can be used to prevent similar accidents in the future.

Snow Drift

One winter afternoon an H-13 pilot was dispatched to the ammunition supply point to pick up flare pots for use at the airstrip. Weather was clear and cold, with wind south at 7 knots. Snow had fallen for several days, and drifts covered most of the countryside. When the pilot arrived at his destination, he noticed that the only snow cleared area was a narrow, plowed pathway on the entrance road to the supply point.

The pilot landed on this pathway which was bounded by 4-foot high snowbanks 9½ feet apart. Supplies consisting of 4 boxes weighing 60 pounds each were carried to the helicopter. Two boxes were placed on the right seat and two secured on a rack built over the right skid.

When the pilot attempted to hover, the helicopter turned about 9 degrees to the left, and the tail rotor struck the snowbank on the

right side of the road. One blade was sheared at the root and thrown 40 feet from the helicopter. The impact also bent the drive shaft and tail boom out of alignment. The pilot immediately pushed collective pitch down, grounding the helicopter and bending the rear cross tube out of limits.

Primarily, this accident resulted because the pilot erred in not maintaining precise directional control when taking off in such a confined area. Snowbanks 9½ feet apart allowed only 4¾ feet of clearance on either side of the tail rotor, or approximately a 7-degree deviation in the heading. Supervisory error is also indicated. Had an area, approximately 55 feet in diameter, been properly cleared for a helicopter landing, this accident would not have happened.

In the event that a landing must be made in an unusually confined area, the pilot should be extremely cautious, particularly during take-off if the load has been changed. As load is increased or decreased, thus shifting the c.g. laterally or longitudinally, required control forces change. The pilot should take these changes into consideration when loading his ship; and, on take-off, he should increase collective pitch very slowly so that he can determine, before he becomes fully airborne, whether or not he can control the ship with its new load.

Which Way Did They Go?

This report concerns an accident which happened in Germany during a recent ferry flight. The flight leader violated prescribed regulations and deviated from good flying judgment. Although the damage incurred was nominal, it is an example of the type of accident that can prove fatal with a little less luck. As do 76 percent of all Army aircraft accidents, it occurred due to pilot error.

The flight plan for the ferry trip listed three planes: one L-20, the lead ship, and two L-17's. The flight of three took off without interplane radio contact, but the L-20 pilot did have radio communications with the control tower and other ground stations. Further, they departed without making any plans concerning formation signals or for signals to be used in the event of an emergency.

Weather, as forecast by Flight Service was 2,500 feet scattered, 4,000 feet overcast with 5- to 7-mile visibility, and scattered showers enroute.

The flight proceeded without incident for 1 hour and 15 min-

utes; then the ceiling began lowering. The flight leader continued on course, endeavoring to remain VFR, but soon he was flying below VFR minimums. As visibility decreased, the pilots of the three aircraft lost sight of each other. The flight leader in the L-20 wanted to turn back at this point, but did not do so for fear of colliding with one of the L-17's. However, the L-17 pilots had already broken formation and were proceeding separately. One L-17 skirted the bad weather and landed at the intended destination; the other landed at a field not far from the point where the formation broke up.

The L-20 pilot was flying lower and lower, until, out of the mist, trees appeared in his flight path. He immediately pushed the prop control and throttle forward and pulled back on the wheel; the airplane hit the trees but remained airborne. The pilot started a climb on instruments and broke out on top at 8,000 feet. He then checked his controls for proper movement and visually checked the aircraft for damage, and it seemed to be in satisfactory flying condition. He let down through the first opening in the overcast and landed at the nearest airfield without further mishap.

The flight leader made his first two errors before take-off. He did not ascertain if radio contact could be maintained between the aircraft of his flight. Further, he did not hold a briefing for the other pilots and plan for visual signaling to indicate turns, let-downs, and climbs. He did not plan a procedure to be followed in the event of an emergency. Failing to brief his flight was in violation of par 33 *a*, section V, AR 95-8, dated 3 Dec 54, which states: "Brief each pilot participating in the flight on weather, flight plan, and other pertinent information." The third error, and the primary cause of the accident as stated in the accident report, was that the pilot continued on course after encountering weather conditions below minimums of visual flight rules. This constituted a violation of visual flight regulations as stated in section III, AR 95-8.

On this flight, when it became evident that VFR flight could no longer be maintained, a shallow 180-degree turn could have been made even without prior planning, but thorough prior planning is always a must in flying; and, to avoid names on tombstones and accident reports, flight regulations must be complied with.

(HELICOPTER MOUNTAIN OPERATIONS cont'd from page 10)
for landing. On the approach, increase the throttle to full open and observe the manifold pressure. If at least 1 inch increase (H-13) is indicated, a safe landing can be made; if there is no increase, possibility of a safe landing is doubtful.

Descent

When descending to an operational base, proper use of downdrafts and diverging air currents can greatly reduce the elapsed time of flight, as well as add to the comfort of personnel aboard. If a letdown is attempted in strong updraft, one may find himself fighting heavy turbulence in autorotation and getting only a very slow rate of descent. The technique of contour crawling is again employed, but in this instance by taking maximum advantage of the downdrafts and descending air currents. *However, special care should be taken to avoid areas of extreme downdrafts and turbulence.* Usually the best controlled rate of descent can be found by flying close to a negative (downdraft) slope in a descending air mass.

In prolonged letdowns when low-power settlings are maintained, care must be taken not to allow the engine to run too cool or carburetor or induction ice to form.

Other Techniques

In mountain flying there are other techniques such as "crow-hopping," a term given to a method of moving the helicopter up to the top of a knoll or to the edge of a pinnacle for take-off when density altitude or load does not permit hovering. To do this, the skids or a portion of the skids are rested on the ground until rpm is built up, then a short hop is made up the ridge until loss of rpm necessitates resting the skids on the ground again. This operation is continued until a point is reached from which a take-off may be made. When landing, the use of a low rate of descent, circular-type approach in lieu of a steep approach for confined area work (creek beds, wooded areas, etc.) is considered good technique.

Conclusion

Techniques discussed in this article might well be practiced at lower altitudes (2,000 to 3,500 feet) with good results; however,

to fully appreciate their value, they must be employed at high density altitudes.

Along with these pilot techniques, the use of skid extensions (18 to 30 inches long) lends invaluable protection for the tail rotor when the helicopter is landed with the nose slightly down slope or is hovered with a heavy load in a tail-low attitude. The extensions also furnish additional flotation and leveling support for landings in soft or rocky areas.

This article was not written as a complete text on how to fly in mountainous areas but only to point out a few of the major differences in technique between low and high altitude flying. Before attempting operational flights at high altitudes a helicopter pilot must make a thorough study of the effect that terrain has on winds, the characteristics of wind currents, and local weather conditions. He must also be highly proficient in the operation of his helicopter. Then, by employing the right techniques, he can safely and dependably operate his helicopter in mountainous terrain above 3,500 feet.

Flood Evacuation Merits Citation

During evacuation operations in Pennsylvania and Connecticut as a result of Hurricane Diane, personnel of the 509th Transportation Company, Fort Belvoir, Va., flew nine H-21C's 189:10 hours between 19 August and 24 August, covering 13,160 miles. They carried 220 persons and hauled 45,570 pounds of food, medical supplies, and emergency equipment. For its work during the emergency, the unit received a citation from the Secretary of the Army. Presentation was made by Under Secretary of the Army Charles C. Finucane during the National Aircraft Show in Philadelphia. Other Army units contributing helicopters and crew members to the operation were the 580th Transportation Company, Fort Bragg, N. C., and the Transportation Aviation Center, Fort Eustis, Va.

Clues in Aerial Photograph Reading

Five important clues aid the aerial photograph reader in identifying objects quickly and accurately.

1. *Relative size:* If one object in a photograph can be identified as having some definite dimensions, the size of other objects can be determined by comparing them with the object. The sizes of roads, railroads, and barracks are well known. Other objects can be compared with them.

2. *Shape:* An object has an entirely different apparent shape from an oblique view than it does from the vertical view. Man-made objects have regular shapes, straight lines, and smooth curves; while the shapes of natural features are irregular.

3. *Shadow:* The shape of an object can be identified more often by its shadow than by its image or its tone. Realization that the camera records all detail in terms of light reflecting properties greatly facilitates understanding aerial photographs. The camera is so sensitive to light that it records the difference in the amount of light falling on reverse slopes as compared to forward slopes, even though the sun is shining directly on both.

4. *Relative tone:* While ordinary film does not register color, it does register in various shades of gray, ranging from nearly black to nearly white. The more light reflected by the surface of an object toward the camera, the whiter it appears on the photograph. A smooth surface appears white when the camera catches the reflected rays of the sun; however, if the light is not reflected to the camera, a smooth surface appears dark. The majority of natural surfaces reflect light in all directions, appearing intermediate in tone. Exposed earth reflects light well; thus gravel and unimproved roads, paths, construction work, and newly plowed fields appear white on aerial photographs.

5. *Relation to surrounding objects:* An object is often identified by its relation to adjacent objects. For example, hangars can be identified by their relationship to aircraft and to the airfield itself. Correspondingly, factories and warehouses can be identified by nearby railroad sidings.

Army Aviation Digest Index: Vol. I, 1955

Here is a fix for "elusive features" published in the *Army Aviation Digest*. Indexed below, alphabetically by subject area and article title, are all articles and features published in Volume I. To use the index, first find the subject area then the article title. For example: To find information on helicopter instrument pilot training, we find the subject area title "Instrument Flight" (note page 42), then we find the article title "Helicopter Instrument Pilot Training." We note that it was published on page 9 of the October issue.

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Straight and Level

TO: Editor-in-Chief

I appreciated the article "Tech Rep Utilization" in the November issue. Many of our people in Army aviation do not fully understand what the job of our technical representatives is. The article was timely and informative.

MORRIS N. DUGGER
Captain, TC
9265th Transportation Unit
St. Louis 1, Mo.

TO: Editor-in-Chief

Please include me on your mailing list for copies of each issue of your *Digest* beginning with the next issue. . . . you may bill me for a 1-year subscription. In case this arrangement is unsatisfactory, please take prompt action to arrange such a subscription . . .

ROBERT H. McCANDLISH
Captain, Armor
Fort Knox, Ky.

The *Digest* staff daily receives requests for subscription service. Unfortunately, subscription service cannot be offered at this time, but it is expected to be available by February 1956. The Bureau of the Budget has authorized the printing of 3200 copies of the *Digest* monthly for Army-wide distribution, and the demand greatly exceeds the supply. It is expected that, beginning with the February 1956 issue, additional copies will be available.—The Editor

TO: Editor-in-Chief

Since graduating from the Army Aviation Tactics Course in 1952, I have been assigned as Aircraft Maintenance Officer with four different organizations. I received these assignments as Maintenance Officer although I had had no prior training in aircraft maintenance. I have enjoyed the assignments and, during the past three years, have learned a lot. But even after three years of such assignments, I feel that I lack background in certain phases of maintenance, background which could be provided in a formal course of instruction.

There are trained aircraft maintenance officers in the TAAM companies, but, with the complexity of our current Army aircraft, *they are also needed* at unit level. We have maintenance directives which, when implemented, provide for unit aircraft maintenance; however, in order to properly implement them, maintenance officers must be better technically trained than the average Army aviator.

It has been my experience that unit maintenance officers are frequently selected by simply choosing the Army aviator who expresses an interest in the maintenance program. To the best of my knowledge, with the exception of the TC maintenance companies, there is no program being conducted with the objective of providing school-trained maintenance officers for aviation units. I would appreciate hearing the views of others on this problem.

JERRY L. TEAGUE
Captain, C.E.
Fort Bragg, N. C.

Letters are welcomed by the ARMY AVIATION DIGEST. To appear in this column they must be signed.—The Editor.